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DATE: **June 10, 2001**

TO: **Trans-Lake Citizen Advisory Committee**

FROM: **Jim MacIsaac**

SUBJECT: **Review of the Eight Pre-Final Alternatives**

THIS INFORMATION REFLECTS MacISAAC's OPINION ONLY

I have reviewed the extensive "Transportation Performance" and "Cost Summary" information produced for the June 6 Joint Committee Workshop. I have boiled down the information into one comparison matrix attached hereto.

Comparison Matrix

The upper portion of the table summarizes the elements provided and Consultant cost opinions for each alternative. The "environmental mitigation" costs represent the midpoints of the ranges offered by the Consultant. Lidding costs reflect only the incremental cost difference between the top end of the range for Alt 2 as the base ($3,480 million) and the top end for each alternative.

The "Performance" data summarizes total 2020 person trips, vehicle trips and transit trips for each alternative with comparisons to the No Action alternative in 2020. Costs for each alternative are divided by the number of new trips accommodated by the alternative compared to No Action. These "cost per trip" results are somewhat meaningless in themselves, but provide a good basis of comparing relative cost versus people-moving performance. This information was used to form my conclusions and opinions offered below.

JWM General Conclusions and Opinions

Public Transit

- The models do strange things with transit mode share. As auto capacity increases, transit ridership increases. The best transit performance occurs with Alts 4 and 8 with HOV and GP lanes added. It appears that transit performance is little affected by type of transit – LRT versus BRT versus HCT.
- The worst transit performance occurs under Alt 5 with HOV & HCT on SR520. Transit carries only 500 more passengers per day than under No Action for a capital cost of $4.7 billion plus mitigation. This Alternative should most likely be eliminated.
- Under Alt 2 LRT on I-90 increases Trans-Lake people-moving performance by less than 2% for a cost of $2.7 billion plus mitigation.
- Transit ridership increases for Alts 3, 4, 6, 7 and 8 appear to be caused by corridor HOV/GP lane capacity enhancements, not by transit service options.
- BRT offers much greater passenger-moving capacity than does LRT (see below).

- Fixed line rail cannot respond to the myriad of differing O-D travel patterns on each side of the lake. BRT is much more flexible since each bus route can be differently routed on each side of the lake, responding to far more differing travel patterns.
- High capital cost LRT/HCT fixed guideway systems should be eliminated from consideration on both Trans-Lake corridors, and BRT systems should be given priority.

Carpool/Vanpool Performance

- Adding HOV lanes to SR-520 increases daily Trans-Lake person-trips in 3+ occupant HOVs by 67% to 90% compared to no action (see Consultant's "Mode Share" chart). Total weekday HOV person-trips on both bridges combined range up to 56,000 by 2020 under Alt 8.
- With 4 HOV lanes, the maximum average is 14,000 person-trips per day per lane. This is about one-half of the daily people-moving capacity of a GP lane. At 3.25 passengers per HOV, 56,000 passengers would ride in 17,200 vehicles, or 4300 HOVs per lane per day. This is about 25% of the LOS C service capacity of a freeway lane.
- Refer to "Traffic Volumes – AM Peak Hour EB and WB" charts supplied by the Consultant. At the SR-520 "Mid-Span Bridge" the AM peak hour HOV estimates under Alt 4 are 1320 WB into Seattle and 1480 EB from Seattle – total 2800 both directions combined. This indicates that 33% of total daily HOVs occur during the AM peak one hour. The charts should perhaps read as "AM Peak 3-Hour Period"?
- With that correction, the HOV lanes would serve 550 HOVs in the peak-hour peak direction by 2020. This represents 45% of the LOS C service capacity of an HOV lane.

Combined Transit and HOV

- Both BRT and 3+ HOV can be easily carried together by 2020 on the HOV lanes on both bridges at about 50% of the HOV lanes' LOS C capacity (55+ mph speeds). This leaves capacity for another 100% increase in transit and HOV use beyond 2020.
- This indicates that shared BRT/HOV lanes on both bridges are the most cost-effective approach to Trans-Lake transit and HOV accommodation. LRT on either bridge would require the equivalent of an additional two lanes of corridor expansion, and leave the HOV lanes less effective in people-moving capacity than the GP lanes.

Non-HOV/Commercial Vehicle Traffic

- From the Consultant's "Mode Share" chart, it can be seen that 78% to 80% of all Trans-Lake person-trips will be traveling in non-HOVs and must use the GP lanes. None of the transit and/or HOV options significantly changes these findings. This means that addition of GP lanes is essential if the large corridor capital investments are to be at all performance and cost effective.

Comments by Alternative

Alternative 1 – No Action

- **Retain** as the No Action basis for all impact comparisons.

Alternative 2 – Safety and Preservation

- **Retain** as a minimum action that is largely essential to the corridor sustenance.
- **Eliminate I-90 LRT** as part of this alternative. I-90 LRT has nothing to do with safety and preservation of either Trans-Lake corridor. It also shows no increase in Trans-Lake person movements compared to No Action, just a shift from HOV to transit. I-90 LRT appears to be a totally ineffective use of $2.7 billion for improving .
- The shoulder and lane-width improvements on SR-520 would result in an increase in vehicular capacity and operational reliability. This is difficult to model, but should be strongly recognized and emphasized in justifying the expense.

Alternative 3 – SR-520 HOV Plus I-90 LRT

- **Drop from further consideration** – performance gain is not worth the cost increase over Alternative 2. Note the minimal gains in Trans-Lake people-movement in the Comparison Matrix for a cost of $6.7 billion plus mitigation costs compared to No Action.
- This alternative slightly increases all modes of Trans-Lake travel, but the overall increase in people-moving performance is only 7% compared to No Action. It results in the second most costly action in terms of cost per Trans-Lake trip accommodated compared to No Action.
- As a minimum, drop I-90 LRT which appears to produce less than a 2% increase in Trans-Lake people-movement compared to No Action. This LRT line may be part of the Sound Transit light rail master plan, but its justification has never been shown – nor does it appear justified by these Trans-Lake corridor studies.
- Replace LRT on I-90 with some action that will provide Transit/HOV lanes in both directions across I-90. This would likely be a much more productive action for HOV as well as transit at far less cost. The Eastside must be given two-way transit/HOV use of this corridor from the East Channel Bridge to Seattle.

Alternative 4 – HOV and GP Plus I-90 LRT

- This alternative is the first that appears to be performance oriented for all modes with 17% to 21% increases in Trans-Lake people moving over No Action. Its cost performance per new trip accommodated is the second lowest of the 7 action alternatives (third lowest for the transit element).
- **Retain this alternative** as both performance and cost effective. However, it would be even more cost effective with two-way BRT on I-90 rather than LRT.

Alternative 5 – HOV and HCT

- This alternative is disastrous in terms of cost versus performance. It accommodates only a 3-4% increase in people-moving performance compared to No Action, and a 1% increase in transit riders for its $4.7 billion transit investment plus mitigation.
- Alt 5 has the second widest cross-section of the action alternatives.
- **Definitely drop this alternative** as totally ineffective compared to cost.

Alternative 6 – HOV + GP + HCT

- This alternative is the 2nd best in terms of increased people-moving performance, but only 4th best in cost effectiveness. The $4.7 billion price tag for HCT really hurts its cost effectiveness and increases Trans-Lake transit ridership by only 12% compared to No Action.
- This alternative creates the widest cross-section of all alternatives studied. It also results in the highest capital cost by far over all other alternatives.
- It is strongly **recommended that this alternative be dropped** in favor of Alternative 8.

Alternative 7 – HOV & BRT

- Substituting BRT for HCT produces much better transit performance and cost effectiveness compared to Alt 5. However, this alternative gains only a 5% to 7% overall increase in people-moving performance compared to No Action.
- It is **recommended that this alternative be dropped,** unless there is a need to bring one HOV lane only alternative into the EIS process.

Alternative 8 – Shared BRT/HOV Plus GP

- This alternative reflects the best performance for increasing Trans-Lake people-moving capacity, and it does so at the least cost by far per trip accommodated compared to all other action alternatives (see Comparison Matrix).
- BRT on both corridors produces the best transit rider performance as well as the least-cost performance of all the action alternatives.

Other Comments on Consultants' Charts

- "Traffic Volumes Criteria Ratings" chart: *"… transit and HOV play large roles in all alternatives"*. Transit and HOV each accommodate 10% of total Trans-Lake person trips under the No Action alternative. These mode shares increase to only 11% or less under all of the action alternatives (see the following "Mode Share" chart). 78% to 79% of all person trips remain in non-HOVs in all action alternatives, compared to 80% under No Action. The Transit & HOV only Alternatives 3, 5 and 7 were the three worst in terms of increased people-moving performance and cost per new trip performance.
- "Mode Share" charts: *All alternatives predict large increases in HOV and transit use compared to 1995."* That is true, but most of that change is due regional factors other than the action alternatives for Trans-Lake. Most of those mode shifts appear in the No Action alternative. Considering the huge investments predicted for the action alternatives, it is imperative that performance gains of the action alternatives be compared to the 2020 No Action alternative – not 1995.
- "Transit Ridership Ratings" chart: *"Cross lake HCT provides capacity for significant travel growth beyond 2020"* So do buses sharing HOV lanes; see capacity comparison below. *"Selection of corridor (for HCT?) depends on factors other than transportation effectiveness"*

Ouch! Least-cost transportation effectiveness should still be the major factor in choosing either or neither corridor for exclusive guideway HCT.

- "HCT Cross Lake Ridership" chart: *"HCT Investment Causes Up to 24% Increase in Transit Use"* This statement needs to be revisited. See AWDT Transit Trips comparisons at the bottom of the attached Comparison Matrix (and Consultant's "Mode Share" charts). The introduction of I-90 LRT in Alt 3 produces only a 7% rider increase for a cost of $2.7 billion compared to No Action. The introduction of SR-520 HCT in Alt 5 produces almost no increase in transit riders compared to No Action. Further increases in transit ridership for the other action alternatives appears to be related to modeling quirks – the more GP capacity added, the higher goes transit ridership. This seems quite the opposite to what we expect to happen.
- "BRT Conclusions" chart: *"May Suffer Reliability Problems"* There seems to be undue emphasis being placed on this issue for bus operations in exclusive or semi-exclusive lanes. This region is investing in 600 lane-miles of transit/HOV lanes to assist high-speed operation of buses, vanpools and 3+ carpools. Rail may also suffer reliability problems on the storm-tossed SR-520 bridge. *"Limited Growth Capacity"* BRT on the Trans-Lake corridors offers far more transit rider growth capacity than does LRT – see capacity comparisons below.
- **Final Comment on BRT:** BRT avoids the need to construct a duplicate set of transit guidways where HOV lanes can already provide that guideway. This region needs to take a stronger approach to HOV lane management – increasing HOV eligibility to 3+ occupant vehicles where 2+ OVs exceed 1250 vehicles per hour, and enforcement that has become nearly non-existent. The 2020 forecasts of Trans-Lake bus vehicles and 3+ OVs when spread across both Trans-Lake corridors will use only about half of the LOS C capacity of the four HOV lanes, leaving ample growth capacity. Eight 63-seat buses can match the crammed capacity of an LRT train, but they offer 8 times more origin-destination travel routing options.

LRT Versus BRT Capacity

- **I-90 LRT Capacity:** Max length train is 4 cars @ 72 seats/car = 288 seated; 533 crammed. Minimum headway = 5 minutes when equally sharing the downtown Seattle transit tunnel with the Airport Link line, or 12 trains per hour. Maximum passenger capacity = 3500 per hour seated and ***6400 per hour crammed each direction***.
- **Equivalent Articulated Buses**: Bus carries 63 seated passengers, 82 seated and standing. Seated: 3500 pass/hour = 56 buses per hour; 6400 pass/hour = ***100 buses per hour.*** Crammed: 6400 pass/hour = ***78 buses per hour each direction.***
- **Exclusive BRT Lane Capacity:** At LOS C (55 mph), a freeway lane can carry 1250 passenger cars per hour. A bus is equivalent to 2 passenger cars. Therefore an HOV lane can carry up to 625 buses per hour at 55 mph or better if exclusive to transit use. BRT on an exclusive lane with all passengers seated has six times greater capacity than LRT operating at minimum headways with crammed loading.
- **Shared Transit/HOV Lane:** 100 buses/hour (equivalent to crammed LRT directional capacity) = 200 passenger-car equivalents (PCEs). LOS C lane capacity at 55 mph = 1250 PCEs. Room

available for 1050 car/vanpools per hour. This is 40% greater than the 2020 HOV estimate in the peak direction on each bridge.

Trans-Lake Capital and Mitigation/Enhancement Cost Opinions of Consulting Team

	Alt 1 No Action	Alt 2[1] Safe & Pres	Alt 3 Add HOV	Alt 4 HOV & GP	Alt 5 HOV & HCT	Alt 6 HOV/GP/HCT	Alt 7 HOV & BRT	Alt 8 HOV/GP/BRT
SR-520[2]								
Safety & Pres	$0	$1,360	$1,360	$1,360	$1,360	$1,360	$1,360	$1,360
Shoulders	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bike & Ped	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TDM	No	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Add HOV Lanes			$1,660	$1,460	$1,060	$1,060	$2,470	$2,010
Add GP Lanes				$1,660		$1,560		$1,560
Add LRT					$4,710	$4,710		
Add BRT							$270	$270
Subtotals		**$1,360**	**$3,020**	**$4,480**	**$7,130**	**$8,690**	**$4,100**	**$5,200**
I-90 Ctr Rdwy[3]								
Bus/HOV	No				Yes	Yes	Yes	Yes
Add LRT	No	$2,720	$2,720	$2,720	No	No	No	No
Total Capital		**$4,080**	**$5,740**	**$7,200**	**$7,130**	**$8,690**	**$4,100**	**$5,200**
Mitigation:								
Noise/Storm	No	$120	$390	$630	$380	$620	$400	$630
Local Street	No	$40	$180	$900	$150	$800	$240	$1,030
Environ (Avg)	No	$230	$320	$400	$400	$480	$230	$290
Lids (Over Base)[4]		Base	$90	$260	$300	$470	$140	$310
Subtotals	**$0**	**$390**	**$980**	**$2,190**	**$1,230**	**$2,370**	**$1,010**	**$2,260**
TOTALS		**$4,470**	**$6,720**	**$9,390**	**$8,360**	**$11,060**	**$5,110**	**$7,460**
Excl I-90 LRT		($2,720)	($2,720)	($2,720)				
Adjusted Totals		**$1,750**	**$4,000**	**$6,670**	**$8,360**	**$11,060**	**$5,110**	**$7,460**
PERFORMANCE Rank Cap/Cost:		**---**	**4 / 5**	**3 / 2**	**6 / 6**	**2 / 4**	**5 / 3**	**1 / 1**
AWDT Person Trips	430,000	430,000	458,000	505,000	445,000	514,000	450,000	527,000
Incr over Alt 1	Base	0	28,000	75,000	15,000	84,000	20,000	97,000
% Incr over Alt 1	Base	0%	**7%**	17%	**3%**	20%	**5%**	**23%**
Cost per new trip[5]	**Base**	**NA**	**$240**	**$125**	**$557**	**$132**	**$256**	**$77**
Peak Period P-Trips	132,000	130,000	140,000	160,000	137,000	158,000	141,000	165,000
Incr over Alt 1	Base	(2,000)	8,000	28,000	5,000	26,000	9,000	33,000
% Incr over Alt 1	Base	-2%	**6%**	21%	**4%**	20%	**7%**	**25%**
Cost per new trip[5]	**Base**	**NA**	**$840**	**$335**	**$1,672**	**$425**	**$568**	**$226**
AWDT Vehicle Trips	288,000	288,000	302,000	333,000	293,000	342,000	297,000	348,000
Incr over Alt 1	Base	0	14,000	45,000	5,000	54,000	9,000	60,000
% Incr over Alt 1	Base	0%	**5%**	16%	**2%**	19%	**3%**	**21%**
Cost per new trip[6]	**Base**	**NA**	**$286**	**$148**	**$800**	**$124**	**$444**	**$111**
AWDT Transit Trips	45,000	48,100	50,200	54,500	45,500	51,100	50,200	56,800
Incr over Alt 1	Base	3,100	5,200	9,500	500	6,100	5,200	11,800
% Incr over Alt 1	Base	7%	12%	**21%**	**1%**	14%	12%	**26%**
Cost per new trip[7]	**Base**	**NA**	**$523**	**$286**	**$8,720**	**$720**	**$213**	**$67**
JWM RECOMMENDATION		**Retain w/o I-90 LRT**	**Drop; not effective**	**Retain w/o I-90 LRT**	**Drop; not effective**	**Drop; too costly**	**Drop; not effective**	**Retain; most effective**

[1] Adding shoulders and lane width to SR-520 under Alt 2 will increase its capacity and reliability.

[2] Cost estimates for highway actions may differ from estimates shown, but sum total matches Consultant estimates.

[3] LRT on I-90 should be eliminated from Alt 2 and remain an option under Alts 3 and 4; I-90 HOV lane resolution needed.

[4] Base = Range from $130 to $3,480. Increase reflects add-on to maximum end of range.

[5] Total Costs divided by trip increase over No Action.

[6] Highway and Mitigation costs for Alt 3 used for Alts 5 and 7; Highway and Mitigation costs for Alt 4 used for Alts 6 and 8.

[7] LRT and/or BRT costs plus HOV lane and Mitigation cost differences from Alts 3 and 4.